

STUDIES IN LIME

WITH SPECIFICATIONS

TIGER FINISH



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STUDIES IN LIME

*A Reference and a Guide
for Architects and Builders*



THE KELLEY ISLAND LIME & TRANSPORT COMPANY
LEADER-NEWS BUILDING
CLEVELAND, OHIO

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THE KELLEY ISLAND LIME & TRANSPORT COMPANY
Cleveland, Ohio

Foreword

THE conception of "Studies in Lime" resulted from a talk with a leading architect who, although equipped with all available literature on the uses of lime, expressed a real need for additional information.

"What architects need," he went on to say, "are details—plastering details of cornices and ceilings, for example, which they can conveniently adapt to work they have in mind. Information on finishes, also more complete specifications on lime plaster would be of great value, too."

In order to supply the need, which so clearly existed, we decided to issue "Studies in Lime" and accordingly, retained this architect, assisted by other architects, to direct the compilation of this book.

Collaborating in production, was an expert plasterer, together with others experienced in the building field.

Consequently, "Studies in Lime" combines in a unique way the vision of the creator with the craftsmanship of the artisan. It contains complete information on where lime can be used to advantage and how to use it, in the building field.

It is offered you in the sincere belief that it will be helpful—a book which you will want to keep in your library or files for convenient and frequent reference.



History of Lime

IT may well be said that the history of civilization has been written in lime mortar.

In Europe, Asia and Africa, in Peru and Mexico, there are remains of work in lime mortar—mute testimony of not only its enduring qualities but also of the skill which its users developed as civilization made progress.

In Egypt the Pyramids contain plaster work applied 4000 years ago, which still exists in perfect condition where undisturbed by willful violence. In fact, it is further written by Millar in his celebrated treatise that plastering of excellent quality was carried on in Egypt "and as long as its civilization continued, added to the comfort of the dwellings of the people and the beauty of its temples."

Apparently, even in these early days the health value of lime plaster was appreciated, for we have on good authority that it was used not only because of its beauty and comfort but hygienic value as well.

To the Greeks is given great credit for the perfection they attained in the use of lime plaster. It was used as stucco for the ornamentation of houses and was of excellent quality; and for whiteness, hardness and polish is said to have rivaled Parian marble.

This was during the time of Pericles and Plato and the art of plastering was developed to a point beyond which little advancement has been made even to this day.

It was from the Greeks that the Etruscans of middle Italy, and later the Romans learned the art. Many notable monuments of these races today remain preserved and bonded by mortar made from lime. Likewise, innumerable examples of fresco and mural paintings still exist because of the integrity of lime plaster.



History of Lime

(Continued)

The importance which the Romans attached to the use of lime plastering may be judged by Pliny's statement to the effect that the Romans had such great faith in it that their laws prohibited the use of lime unless it had been kept for three years.

In those days the only lime available was quicklime which required great care and long periods of time for slaking and aging. The advent of hydrated lime which eliminates this long, laborious slaking and aging is comparatively recent.

The master-pieces of such men as Michelangelo, Leonardo di Vinci and others, have been preserved to us largely because of the fact that they were painted directly on lime plaster.

Later on, in England, in the sixteenth century, very notable work was done, the Plasterers Company being inaugurated in 1501.

In our own country there are numerous examples, from the earliest days, of the use and enduring qualities of lime plaster, in the majority of the older public buildings; for example, Faneuil Hall, Boston, Mass., and Independence Hall, Philadelphia.

And today a history of architecture in America is being written to a large extent in lime plaster—the structural material of the ages.



The Lime of Today

To anyone who studies the subject of plaster and mortar from the advent of plastering to the present time, the continual and predominant use of lime is evident.

From the time early man first heated lime rocks by building his fire of stones around them, thereby obtaining a plastic substance to supersede the mud he formerly used—from that time, tracing the progress of plastering through Egyptian, Grecian, Roman and English history to the present, we find the universal plastering material to be lime.

The lime of those ancient days was a quicklime or "lump lime," as now commonly designated. And some lump lime is still used.

Hydrated Lime

However, because of the lack of facilities on the job for slaking lump lime, the time and expense involved and probability of poor results through the use of improperly slaked lime—because of all these, there is a universal preference for hydrated lime.

Furthermore, the shipping and handling of unslaked lime is more or less unsatisfactory.

Thus, the great value in hydrated lime lies in the assurance of perfect slaking and ease in handling as compared with the impracticability of perfect slaking of lump lime and difficulty in handling.

Manufacture

In the manufacture of Kelley Island Hydrated Limes (TIGER FINISH and TIGER MASONS') the desired grade of limestone is selected and quarried. It is then calcined (heated) to expel the carbon dioxide and crushed to such a fineness that it passes through a $\frac{1}{4}$ -inch mesh screen.



Manufacture

(Continued)

This crushed material is then proportioned with water by weight, in large steel cylinders. Only as much water is added as will combine chemically with the lime oxide, converting it into a hydroxide and reducing it, through an air separation process, to a fine, dry, impalpable powder like flour.

This hydrating is performed under the supervision of chemists who are specialists in this work. Every particle is thoroughly slaked.

It is evident that the chemical analysis might be duplicated—provided rock were available with certain ingredients. But it is an interesting fact that in what is known as the White Rock District of Ohio the lime rock (magnesian limestone) has certain natural physical qualities unequalled anywhere else in the world for making finishing hydrate. There is no deposit like it the world over, so far as we know.

From this famous deposit TIGER FINISH is made.

And every operation from blasting the rock in the great quarries to filling the heavy valve paper sacks and pyramiding them in the cars for shipment, is directed and supervised with utmost care.

“Spreads Like Warm Butter”

Due to the natural physical qualities of the rock from which it is made and the care and skill used in manufacture, TIGER FINISH has unusual plasticity.

It spreads further with less effort. It is absolutely free from discoloration of any kind. Its use by skilled mechanics results in exceptionally smooth surfaces, perfect corners and angles.

Plasterers in their enthusiasm over TIGER FINISH describe it as the lime which “*Spreads like warm butter,*” and these four words tell practically the whole story.



The Use of Lime

In construction work lime offers certain definite advantages for preparation of the following:

- (1) Interior plaster.
- (2) Portland cement mortars. (Including stucco.)
- (3) Portland cement concrete.

Each of these divisions will be considered and the information pertaining thereto placed under the appropriate heading.

Interior Plaster

The favor in which lime is held for this class of work results from several features of this product:

- (1) Plasticity.

TIGER FINISH lime plaster is decidedly plastic—and the more plastic a lime mortar is, the smoother the walls and the more perfect the angles. The more plastic a mortar or plaster, the better workmen like it.

- (2) Hygienic qualities.

Lime is generally acknowledged as a cleanser—vermin avoid lime. The health value of lime has been appreciated through the ages.

- (3) Acoustic properties.

Lime plaster is the *only* plaster of real good acoustic properties. The millions of minute air cells in this material constitute an effective barrier to the penetration of sound. They absorb sound. TIGER FINISH lime plaster insures peaceful, quiet interiors.

- (4) Economy.

Contractors like TIGER FINISH lime because of its great sand carrying capacity. It is generally recognized that lime will carry much more sand than any other plastering material. Furthermore, builders can use the plaster that drops on the floor. And their men may work right up to quitting time, since any plaster left in the box can be retempered in the morning.

In addition to these features of superiority, lime plaster is fire resistant and provides a surface that is strong and durable, sufficiently hard for all purposes and every use.



Wall Finishes

The variety of finishes possible in the use of lime plaster is limited only by the ingenuity of the architect and skill of the plasterer.

The most common is, of course, the *smooth trowel finish* which is to be papered or canvassed and painted, or sometimes merely painted—office buildings, for example. (Specifications page 37.)

When the surface is to be tinted or painted, the *sand finish* meets with great favor. It has life and texture impossible to obtain in the smooth, flat finish. Many different textures can be secured through variation in the size of sand used and methods of treatment.

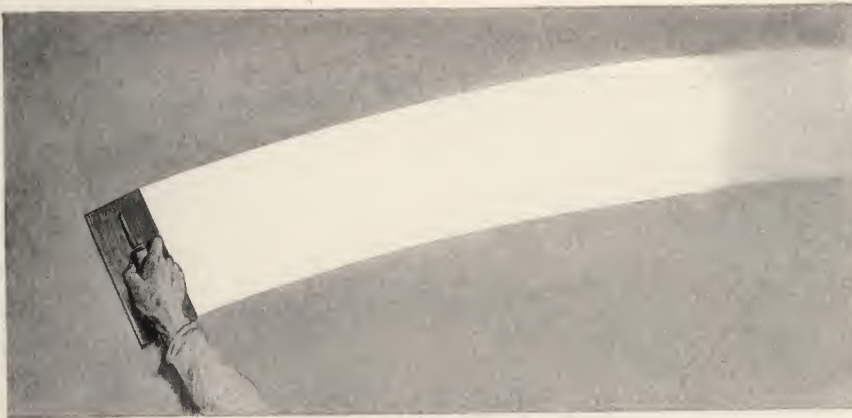
A wood float gives a smooth sand finish. A cork float gives a medium or rough finish. A carpet-covered float produces a rough texture. (For specifications see page 38.)

The style or texture of *antique finish* is usually designated by the architect. With a mixture of two parts of TIGER FINISH and one part of a good grade of plaster paris, any desired effect can be obtained, as follows:

Cover all brown mortar visible, then with a 4-inch paint brush, sponge, cloth or trowel, apply more of the mixture to white surface, keeping in mind the kind of surface wanted. If surface be too rough, rub down with wet cloth. The general specifications on proportions of mixture apply—see page 37.

Among the antique finishes, there are endless possibilities for the real artisan. Many of the attractive effects obtained through careful mixing of lime plaster and skillful manipulation of the materials on the part of the plasterer, are difficult to name and describe. The idea is usually conveyed through a sample of the work which is made up under direction of architect or plasterer and is used as a guide for the job.





SMOOTH FINISH

Suitable for offices where walls are to be painted and for homes where walls are to be canvassed and painted or papered, or waxed and painted.



SAND FINISH

The wide variety of textures possible in this finish recommends it for homes where artistic effects in wall treatment are desired and where the walls are to be tinted or otherwise decorated.



ANTIQUE FINISH

The possibilities in this style of finish are practically unlimited. Its use in finer homes and even in offices is becoming more general where effects of unusual character or beauty in wall finish are sought.

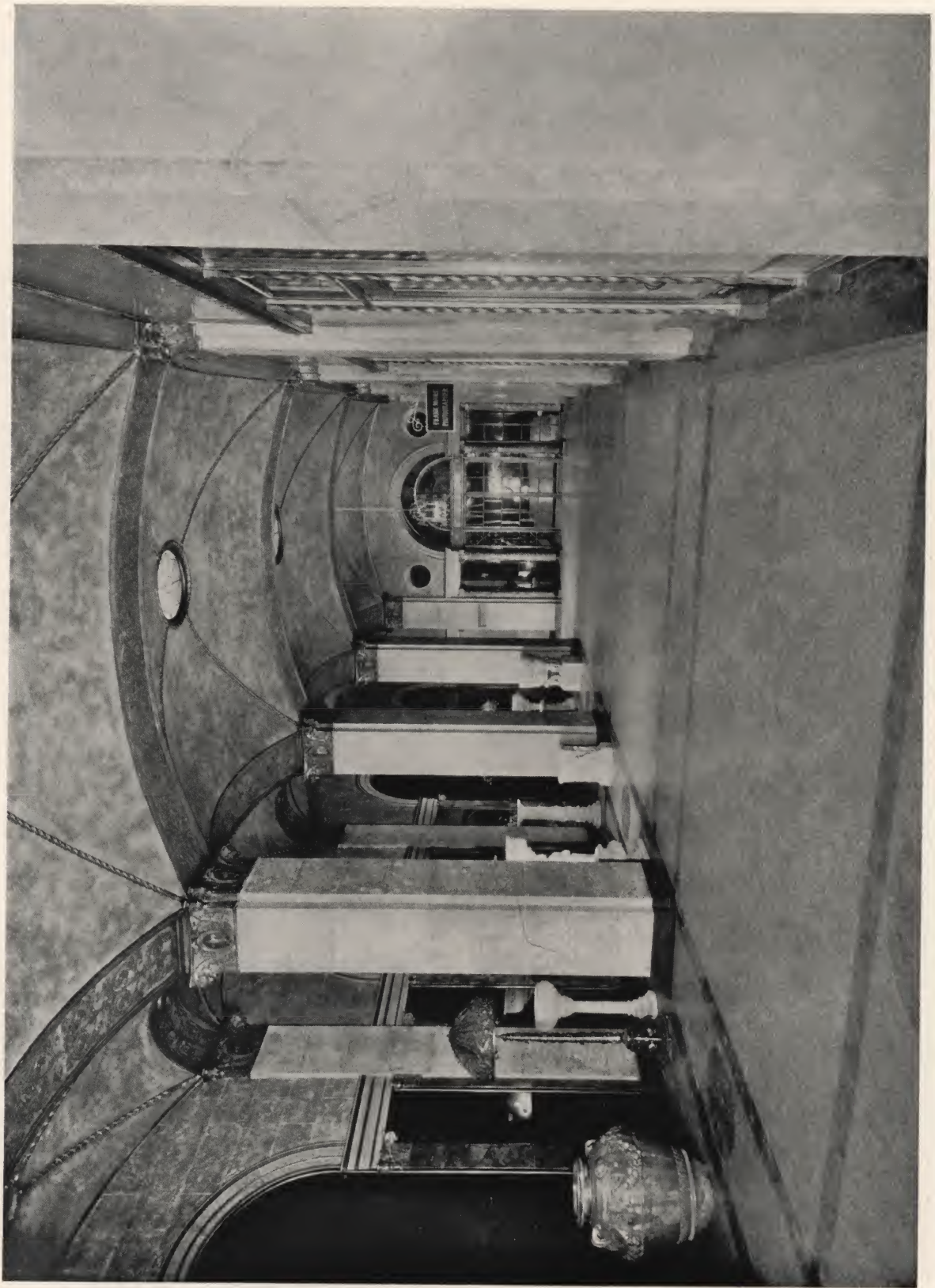




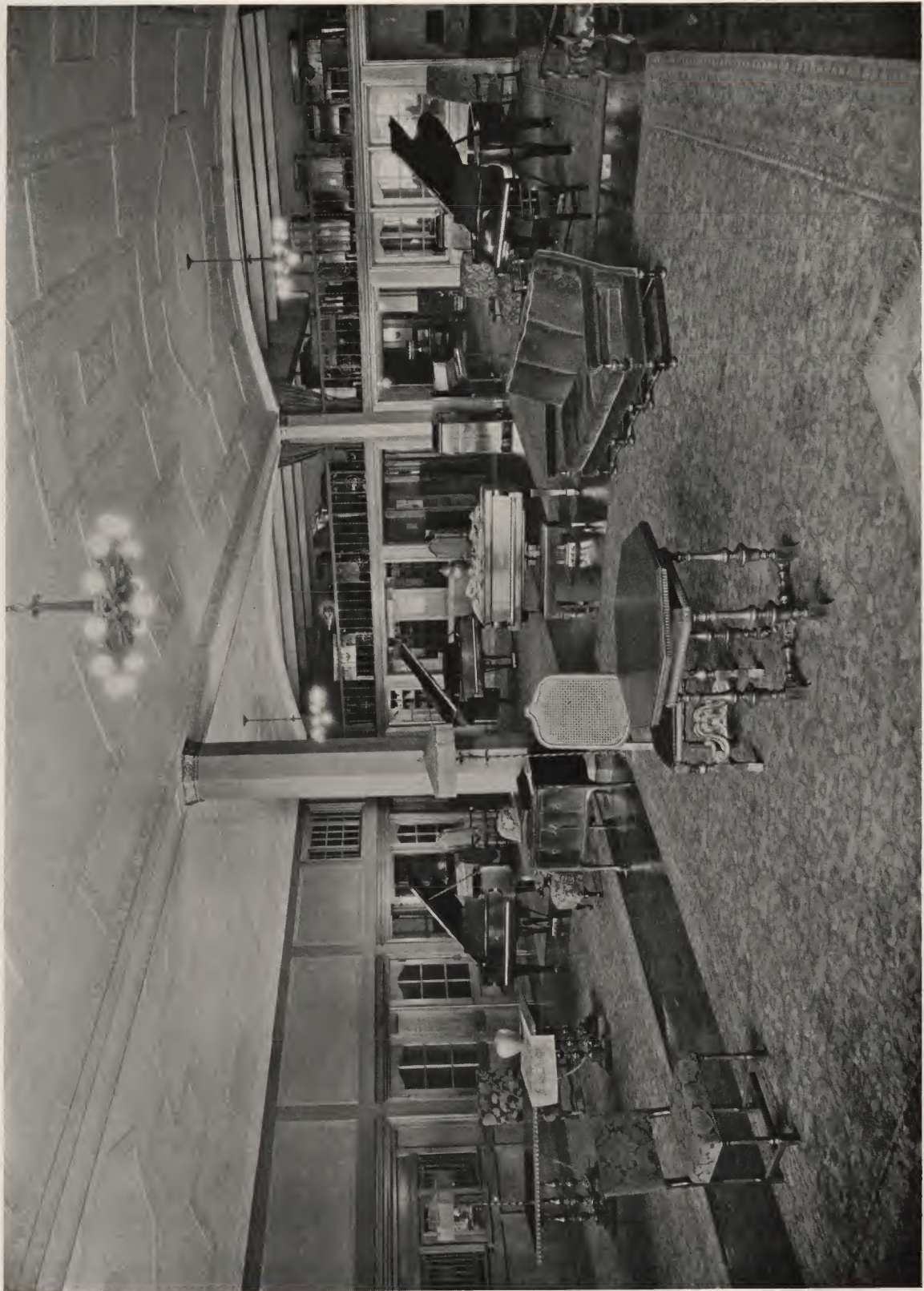
So closely does this handsome wall of TIGER FINISH lime plaster resemble Caen Stone that only the careful scrutiny of an expert reveals the difference. Cornice and ceiling are also of the same material.



Of particular interest are the unusual wall effects executed so perfectly because of the adaptability of TIGER FINISH lime plaster.



A tribute to the vision of the architect, the craftsmanship of the artisan and the faithfulness of materials used is this ceiling in TIGER FINISH lime plaster.



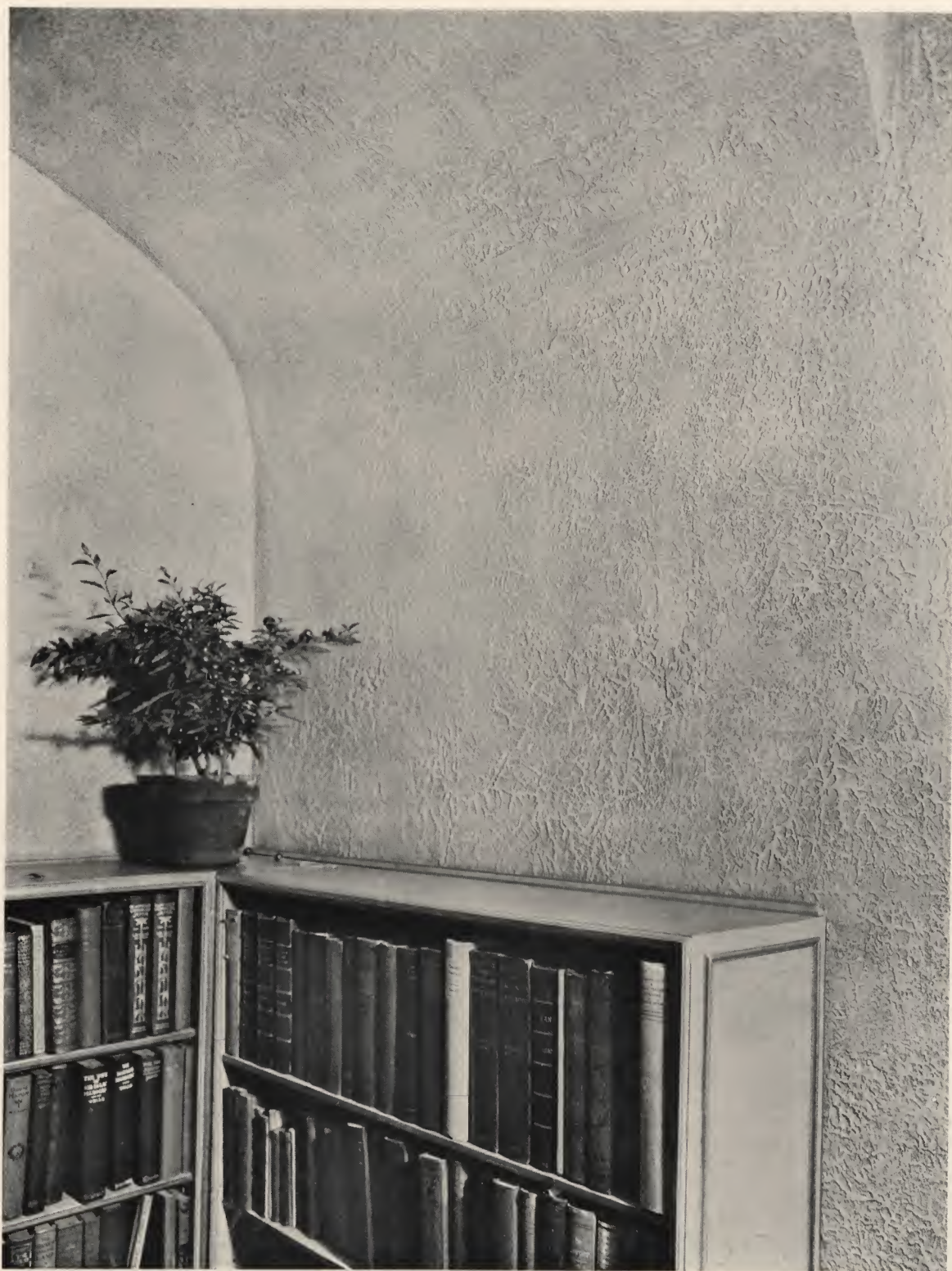
How expertly the ceiling with its graceful arch and interesting motif, as conceived by the architects, has been produced by the artisan.



It is interesting to note the detail of pilasters, columns and walls as expressed in lime plaster.



The value of TIGER FINISH lime plaster in obtaining the straight, even mouldings at the base of the arches, is of particular interest.



This attractive texture of finish, as carried out in an architect's home, is of unusual interest.



*Not alone in texture, but in faithfulness of execution of architectural design, lies the merit of TIGER
FINISH lime plaster.*



These perfect corners and angles are characteristic of TIGER FINISH lime plaster because of its exceptional plasticity.

Color



A simple geometrical ceiling design adds greatly to the beauty of the room. The one shown above is simple to obtain as it is merely run in place and the rosettes set in. Most of the cornice is run in place except the ornamental frieze which is pre-cast.

Notes on Plastering

(a) For good work, the surfaces to receive plaster should be rigid, straight and true, also free from dust, excess water and any foreign substance. They must be capable of holding plaster.

(b) All blocking grounds or nailing for fixtures or finish must be set and secure before plastering is commenced to avoid cutting and patching.

(c) All plumbing or other pipes, electric wires, conduits, etc., must be placed before plastering is commenced, to avoid cutting and patching.

(d) The best wood lath is white pine, although spruce is not undesirable. Yellow pine lath contains pitch.

In nailing, lath should have a nail to each bearing (nailings should be 12 to 16 in. on centers) and if the lath are wide they require two nails at each end of lath.

The spacing of wood lath for hydrated lime plaster should be about $\frac{3}{8}$ in. in the clear and joints broken about every sixth course. When lath rests on a bearing surface over 2 in. in width, strips of wood should be placed under lath to allow a space for keying the plaster. Half green laths are best for use and dry laths should be wet before using. No lath should run through partitions from one room to another.

All corners should be thoroughly blocked behind lath.

Strips of metal lath should be used over the wood lath at all interior angles of wall and ceilings.

Galvanized metal corner beads, if specified, should be applied to all external angles before plastering is applied.

All knots (only tight knots should be permitted in wood lath used) and sappy places in the lath should be thoroughly primed with shellac before plastering is applied. Where structural timbers are not "sized" or do not produce a true plane, the surfaces should be furred to a true plane before lathing.

(e) Where plaster board is used it should be applied so as not to produce long continuous joints, and the joints covered with burlap set in plaster of paris or other suitable keying device to insure against the cracking of plaster at the joints. The center of the board should be nailed first and the edges last. Nails should be $1\frac{1}{4}$ in., 11½ gage, $\frac{7}{16}$ in. head, smooth wire nails set 4 in. apart with each nail driven firmly.

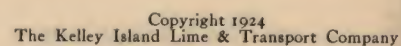
Ceilings should be furred when leveling is required.

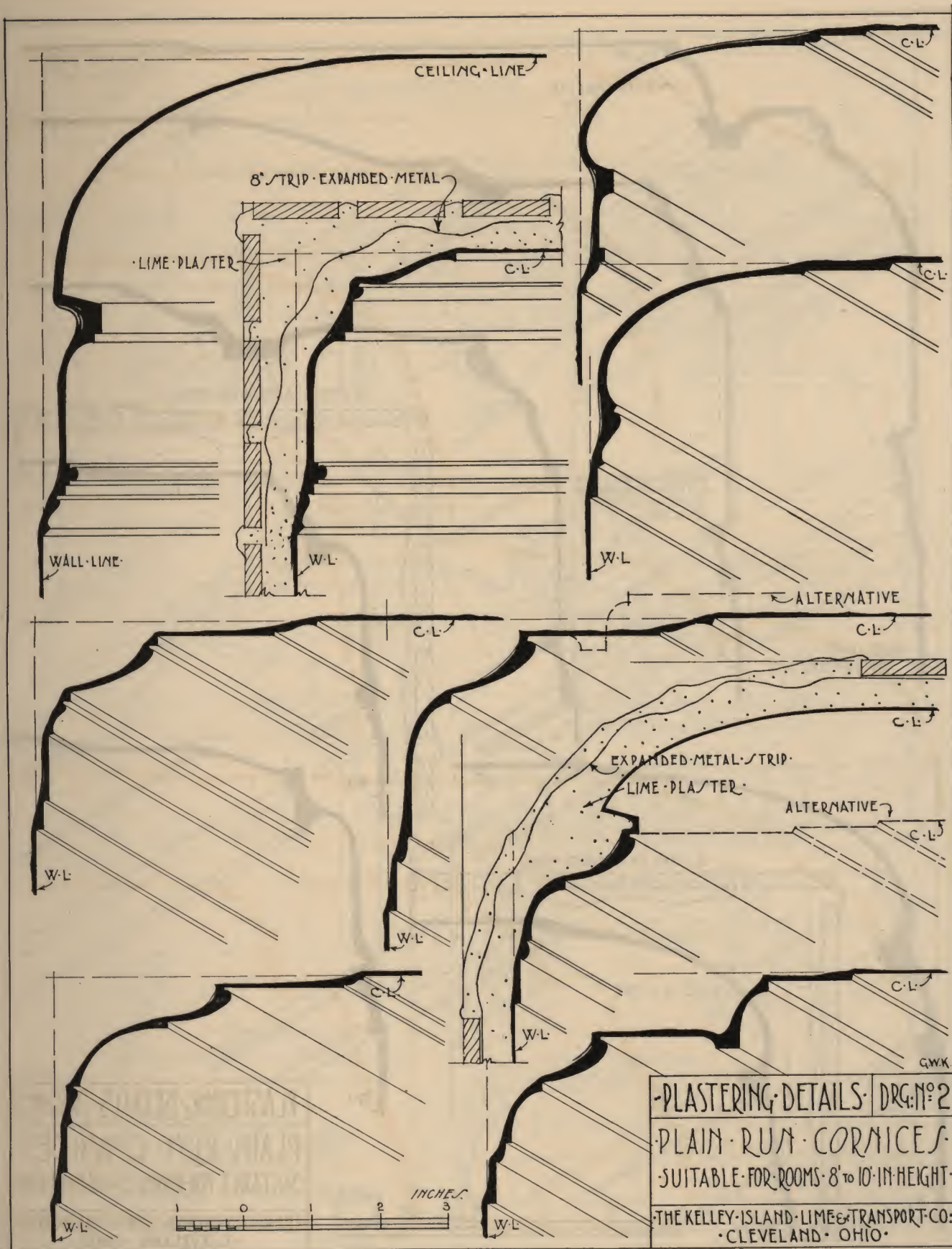
(f) Metal lath should be applied in accordance with standard specifications recommended by the Associated Metal Lath Manufacturers, Chicago, Ill.

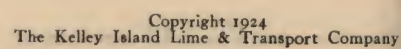
(g) Grounds for plastering on wood lath should be $\frac{3}{4}$ in.; for metal lath, $\frac{3}{4}$ in.; over brick and tile, $\frac{3}{4}$ in. and over plaster board, $\frac{3}{4}$ in.

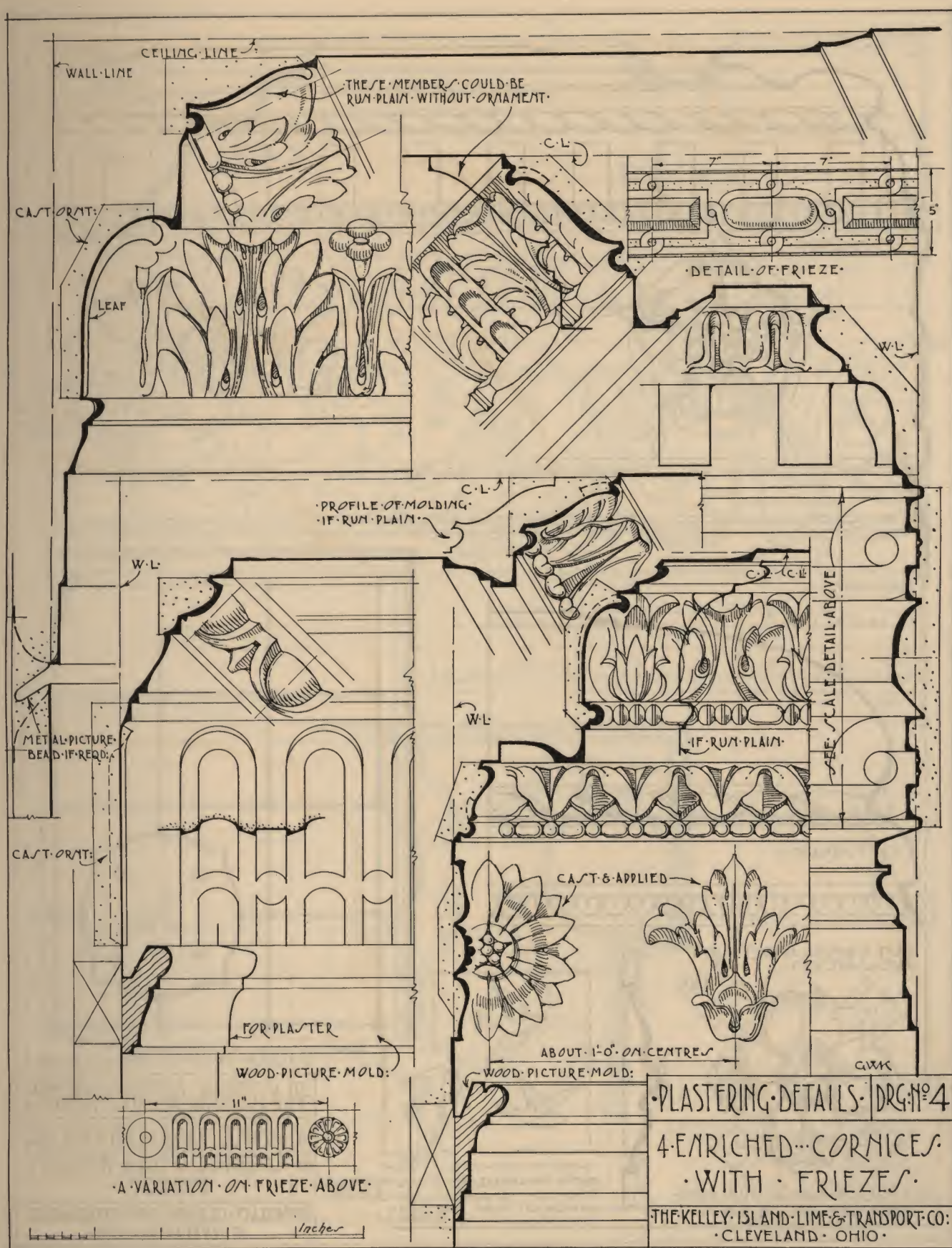
(h) Screeds should be used to insure the full thickness of plaster specified.

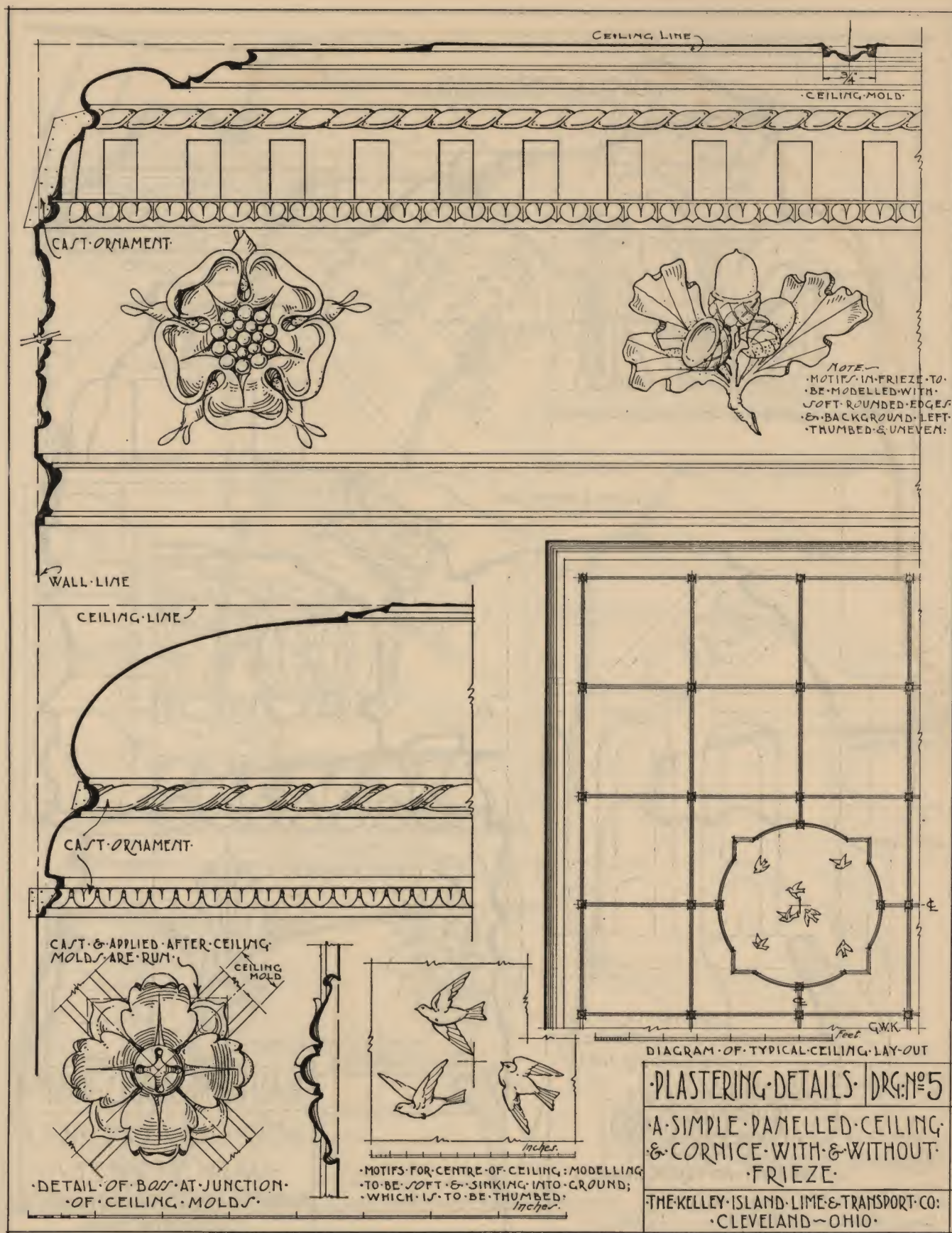


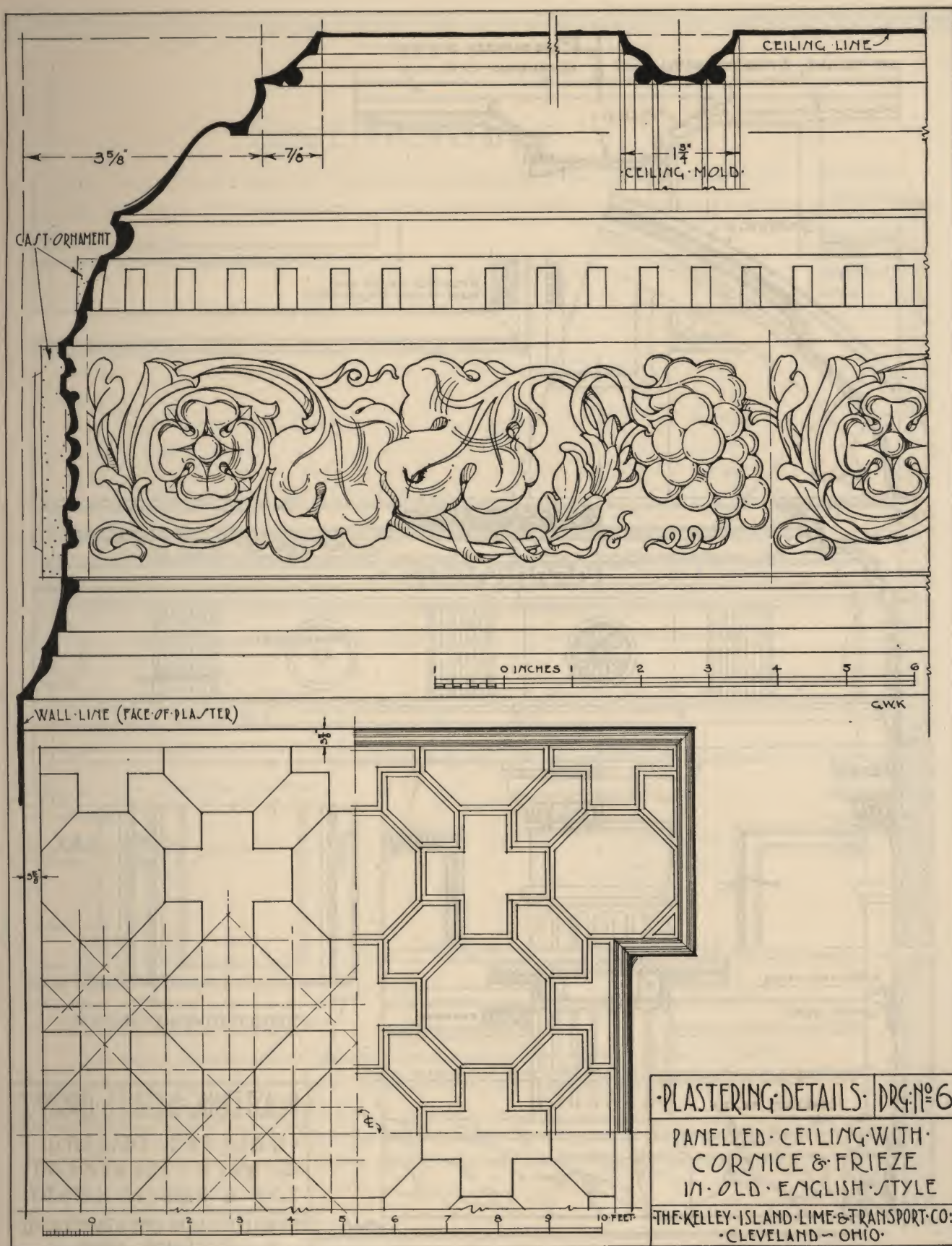


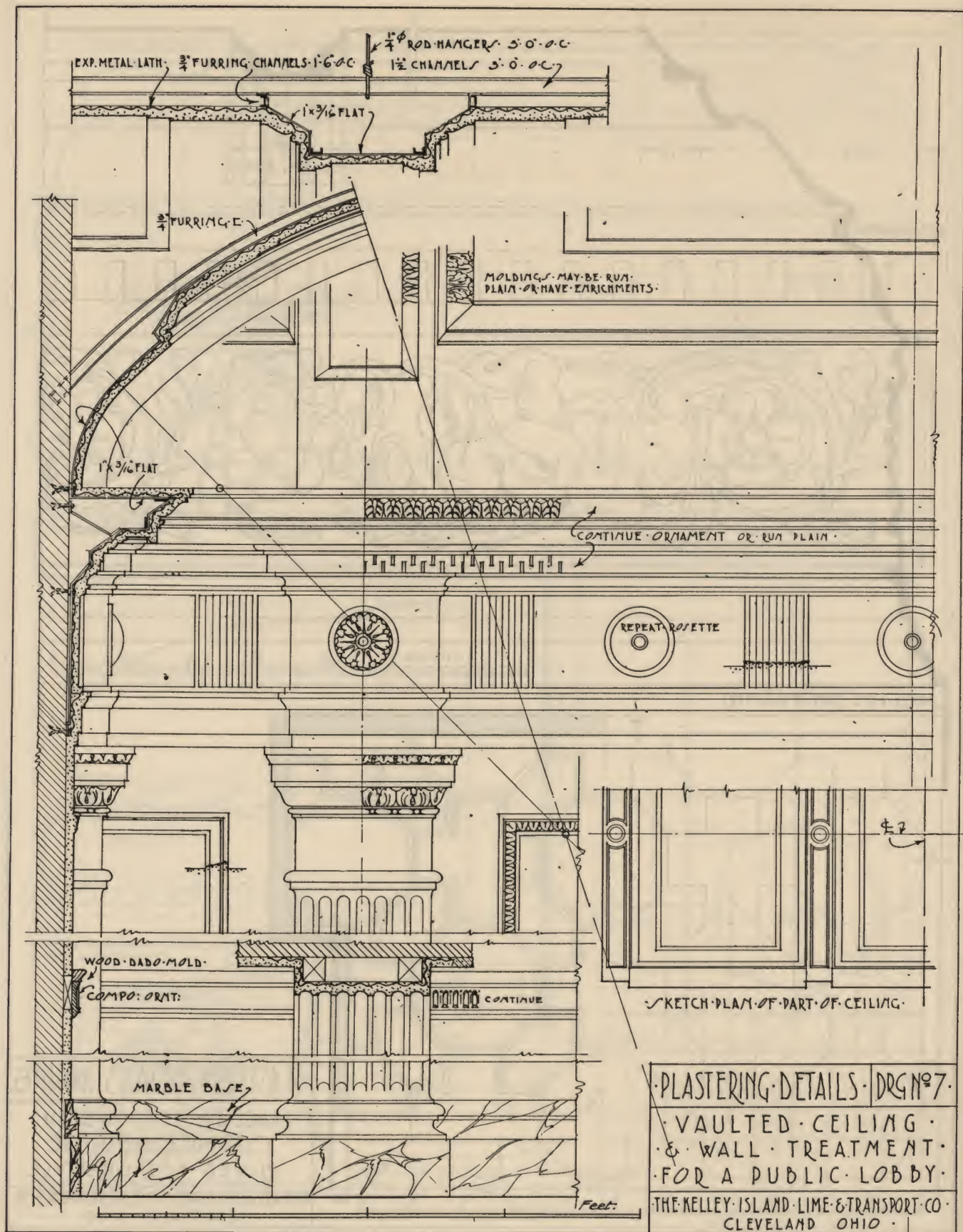












Specifications

Soak TIGER FINISH in a water-tight box to form a medium paste. Then add sand and hair in the following proportions. Mix thoroughly and, to obtain best results, allow mortar to stand at least 24 hours before applying.

Quantities per ton mortar (dry).

Scratch Coat

TIGER FINISH Hydrated Lime (9 sacks)	450 lbs.
Plastering Sand	1,550 lbs.
Hair	4 lbs.

Brown Coat

TIGER FINISH Hydrated Lime (8 sacks)	400 lbs.
Plastering Sand	1,600 lbs.
Hair	1 ½ lbs.

Plastering shall be to ⅞ grounds.

Apply scratch coat with enough pressure to insure a perfect clinching key and to cover all metal. When surface is sufficiently firm scratch same with a scratcher to insure a good bond for second coat. Let scratch coat dry before applying second coat.

Second, or brown coat, shall be applied to bring surface out even with grounds. Use rod and darby to work up a straight and even surface. When surface is firm but not hard or dry rub evenly with float to insure against shrinkage cracks.

Allow mortar to dry before finishing.

For finish see pages 37 and 38.

The mortar shall be a mixture of properly slaked lump lime with sand and hair in the following proportions. Allow to age three days or more.

Scratch Coat

Stiff Lime Putty	1 part by volume
Plastering Sand	2 parts by volume
Hair	3 lbs. per yd. sand

Brown Coat

Stiff Lime Putty	1 part by volume
Plastering Sand	3 parts by volume
Hair	1 ½ lbs. per yd. sand

Plastering shall be to ⅞ grounds.

Apply scratch coat with sufficient pressure to insure a perfect clinching key and to cover all metal. When surface is sufficiently firm scratch same with scratcher to insure a good bond for brown coat. Allow scratch coat to dry before applying second coat.

Second, or brown coat, shall be applied to bring surface out even with grounds. Use rod and darby to work up a straight and even surface. When surface is firm but not hard or dry, rub evenly with float to insure against shrinkage cracks.

Allow mortar to dry before finishing.

For finish see pages 37 and 38.

**Three Coat
Lime Plaster
on Metal Lath
Using Tiger
Finish
Hydrated
Lime**

**Three Coat
Lime Plaster
on Metal Lath
Using Kelley
Island Lump
Lime**



Specifications

Two Coat Lime Plaster On Wood Lath Using Tiger Finish Hydrated Lime

Thoroughly soak TIGER FINISH in a water-tight box to form a medium paste. Then add sand and hair in the following proportions. Mix thoroughly and, to obtain best results, allow mortar to stand at least 24 hours before using.

Quantities per ton mortar (dry).

Scratch Coat

TIGER FINISH Hydrated Lime (9 sacks)	450 lbs.
Plastering Sand	1,550 lbs.
Hair or Fibre	3 lbs.

Apply a coat of mortar with sufficient pressure to insure a good key back of lath. Double up with sufficient mortar to bring out to grounds. Use a rod and darby to bring to an even surface. When surface is firm but not hard or dry rub evenly with a float to insure against shrinkage cracks in brown coat.

Allow mortar to dry before finishing.

For finish coat see pages 37 and 38.

Two Coat Lime Plaster On Wood Lath Using Kelley Island Lump Lime

The mortar shall be a mixture of properly slaked lump lime, sand and hair. Mix in the following proportions. Allow to age three days or more.

Scratch Coat

Stiff Lime Putty	1 part by volume
Plastering Sand	2 parts by volume
Hair or Fibre	3 lbs. per yd. sand

Plastering shall be $\frac{5}{8}$ inch thick.

Apply thin coat of mortar with sufficient pressure to insure a good key back of lath. Double up with enough material to bring out to grounds. Use rod and darby to bring to a true and even surface. When surface is firm but not hard or dry, rub evenly with a float to insure against shrinkage cracks in brown coat.

Allow mortar to dry before finishing.

For finish coat see pages 37 and 38.



Specifications

Soak TIGER FINISH in a water-tight box to form a medium paste. Then add sand and hair in the following proportions. Mix thoroughly and, to obtain best results, allow mortar to stand 24 hours before applying.

Quantities per ton mortar (dry).

Scratch Coat

TIGER FINISH Hydrated Lime (9 sacks)	450 lbs.
Plastering Sand	1,550 lbs.
Hair	3 lbs.

Brown Coat

TIGER FINISH Hydrated Lime (8 sacks)	400 lbs.
Plastering Sand	1,600 lbs.
Hair	1 1/2 lbs.

SCRATCH COAT

Apply scratch coat with sufficient pressure so as to insure a good key back of lath. Use a scratcher to rough up surface to form a bond for brown coat. Allow scratch coat to thoroughly dry before applying brown coat.

BROWN COAT

Apply to scratch coat sufficient material to bring out to grounds. Use rod and darby to bring to even surface. When surface is firm but not dry, rub with float to insure against shrinkage cracks. Allow brown coat to thoroughly dry before finishing.

For finish see pages 37 and 38.

The mortar shall be a mixture of properly slaked lump lime, sand and hair. Mix in the following proportions. Allow to age three days or more.

Scratch Coat

Stiff Lime Putty	1 part by volume
Plastering Sand	2 parts by volume
Hair	3 lbs. per yd. sand

Brown Coat

Stiff Lime Putty	1 part by volume
Plastering Sand	3 parts by volume
Hair	1 1/2 lbs. per yd. sand

SCRATCH COAT

Apply scratch coat with sufficient pressure so as to insure a good key back of lath. Use a scratcher to rough up surface to form a bond for brown coat. Allow scratch coat to thoroughly dry before applying brown coat.

BROWN COAT

Apply to scratch coat sufficient material to bring out to grounds. Use rod and darby to bring to even surface. When surface is firm but not dry, rub with float to insure against shrinkage cracks. Allow brown coat to thoroughly dry before finishing.

For finish see pages 37 and 38.

**Three Coat
Lime Plaster
On Wood Lath
Using Tiger
Finish
Hydrated
Lime**

**Three Coat
Lime Plaster
On Wood Lath
Using Kelley
Island Lump
Lime**



Specifications

Two Coat Lime Plaster on Gypsum Block, Brick, Tile, etc. Using Tiger Finish Hydrated Lime

Soak TIGER FINISH in a water-tight box to form a medium paste. Add sand and hair in the following proportions. Mix thoroughly and, to obtain best results, allow mortar to stand at least 24 hours before applying.

Quantities per ton mortar (dry).

First Coat

TIGER FINISH Hydrated Lime (10 sacks).....	500 lbs.
Plastering Sand.....	1,500 lbs.
Hair.....	1 ½ lbs.

Plastering shall be to 5/8 grounds.

Apply a thin coat to surface to insure a good bond. Double up and bring out to grounds with a *leaner* mixture, adding at least one part more sand to above proportions. Use rod and darby to bring to an even surface. When surface is firm but not hard or dry, rub evenly with float to insure against shrinkage cracks.

Allow mortar to dry before finishing.

For finish see pages 37 and 38.

Two Coat Lime Plaster on Gypsum Block, Brick, Tile, etc. Using Kelley Island Lump Lime

The mortar shall be a mixture of properly slaked lump lime, sand and hair. Mix in the following proportions. Allow to age three days or more.

First Coat

Stiff Lime Putty.....	1 part by volume
Plastering Sand.....	3 parts by volume
Hair.....	1 ½ lbs. per yd. sand

Plastering to be to 5/8 grounds.

Apply a thin coat to surface to insure a good bond. Double up and bring out to grounds with a *leaner* mortar adding at least 1 part more sand to above proportions. Use rod and darby to bring to an even surface. When surface is firm but not hard or dry, rub evenly with a float to insure against shrinkage cracks.

Allow mortar to dry before finishing.

For finish see pages 37 and 38.



Specifications

Soak TIGER FINISH in a water-tight box to a medium paste. Then add sand and hair in the following proportions. Mix thoroughly and, to obtain best results, allow mortar to stand 24 hours before applying.

Quantities per ton mortar (dry).

Scratch Coat

TIGER FINISH Hydrated Lime (9 sacks)	450 lbs.
Plastering Sand	1,550 lbs.
Hair or Fibre	3 lbs.

For finish coat see below and page 38.

Prepare the concrete surface by thoroughly hacking and roughening to form a mechanical bond. Then brush or wash free from scale or dust before applying plaster.

Apply plaster as thinly as possible.

As plastering on concrete cannot be guaranteed, we recommend furring and lathing of all concrete surfaces.

**Two Coat
Lime Plaster
On Concrete
Using Tiger
Finish
Hydrated
Lime**

The use of TIGER FINISH after preparation in the proper way by skilled mechanics results in a beautiful white finish with an even surface.

- (1) Use a water-tight box in which to soak the lime.
- (2) See that box is free from all dirt.
- (3) Use only clean water and fill box about three-fourths full.
- (4) Sprinkle lime into water, allowing both to thoroughly unite.
- (5) Don't leave any lime dry or semi-dry on top of water when box is full. Water should slightly cover lime.
- (6) The best results can be obtained by soaking lime 24 hours.
- (7) The longer it soaks the richer it works.
- (8) Lime half soaked leaves a half plastic putty lime; thoroughly soaked, it forms a smooth, easy working putty—"It spreads like warm butter."

**Finish Coat
(White)
Using Tiger
Finish
Hydrated
Lime**

Place required amount of putty on mortar board. Form ring in same. Pour in water, then sprinkle in plaster paris to form about a 25-75 plaster and putty gauging. Mix the two together thoroughly—applying evenly to walls or ceilings.

Trowel sufficiently to bring to a smooth surface.



Specifications

Sand Finish Using Tiger Finish Hydrated Lime

TIGER FINISH Hydrated Lime.....1 part by weight

Plastering Sand.....3 parts by weight

Mix lime and sand thoroughly in dry form on clean floor or platform, then screen same through a No. 10, 12 or 15 screen (according to texture required) into a clean box. Add sufficient water to bring to a working consistency. If possible, allow to stand over night to insure perfect results.

Apply mixture on walls and ceilings evenly, covering all mortar surfaces. Double up with same material and bring to smooth, even surface. Follow closely with a wood, cork or carpet float, using a brush and water, to keep the material moist in working, scouring surface to bring it to even texture.

Wood float leaves a smooth, sand finish surface. Cork float leaves a medium rough surface and a carpet float leaves a rougher surface.

Covering Capacities

For a first class white coat job TIGER FINISH will cover approximately 800 square yards to the ton. (Average bulk of putty per 50-pound bag is a fraction over 1 cubic foot.)

One ton of TIGER FINISH equals 45 cubic feet.

One ton of TIGER FINISH, properly proportioned with a good plastering sand, will make enough mortar to average 400 square yards of scratch and brown coats combined, ready for finishing.



Memoranda



Memoranda



Lime in Mortar

(Tiger Masons')

It is common practice to use hydrated lime in portland cement mortars for such work as laying brick, stone, marble, granite and tile setting.

The amount to use is 25%, 50% and 100% (50-50 mortar) of hydrated lime by weight of portland cement used. The 100% mortar is known as a 50-50 mortar, and is highly recommended for all masonry.

The advantages of hydrated lime in this class of work are very pronounced and may be summarized as follows:

(1) Hydrated lime renders the mortar thoroughly plastic so that the brick, stone, tile or other masonry units will slide freely and may be embedded firmly and without effort, while the mortar itself flows into crevices that cannot be reached with a trowel. The tendency where hydrated lime cement mortar is used is for the masonry unit to seek its own natural bed.

(2) It helps to retain sufficient amount of moisture which the so-called "suction" of brick would otherwise absorb and would thereby deprive the portland cement of sufficient water for hydration and hardening. The hydrated lime practically waterproofs the bonding surface of the masonry unit so that the absorptive qualities of the unit cannot "rob" the mortar of the moisture necessary for natural curing; and consequently adds to compressive strength.

(3) Hydrated lime cement mortar permits the practical laying of masonry walls when temperatures are so low as to make cement mortar work unsafe; the oily fatness of the lime keeps the mass active during the process of initial set.



Lime in Mortar

(Continued)

What authorities say:

"Tests made with mortars to which lime paste has been added, showed that the addition of 10 per cent lime increased the adhesive strength 120 per cent to 140 per cent, 16.7 per cent lime added increased it 130 per cent to 160 per cent, 25 per cent lime added 110 per cent to 120 per cent, 50 per cent lime added 75 per cent to 80 per cent. The addition of lime increased the ratio of adhesion to cohesion in all percentages."

Mills' "Materials of Construction"

"---- the addition of hydrated lime to portland cement mortar makes the latter easier to work and more plastic, but the most interesting result noticed is an actual increase in tensile strength when the addition does not exceed 10 per cent to 20 per cent."

Kidder's "Building Construction"

"Cement mortar is improved by the addition of a small amount of hydrated lime. It makes it work more smoothly under the trowel and increases its waterproofness----"

*Woolson, 1920 Building Code recommended by the
National Board of Fire Underwriters*

Stucco

Since portland cement stucco is actually a mortar, it is apparent that lime when added to it will produce beneficial results, just as it does when added to a mortar for laying brick or other work.

In stucco, the particular advantages gained in the use of lime are plasticity in application and water-tightness in service. Furthermore, since lime retains moisture in the mass during curing, it tends to minimize hair cracking.

The quantity to employ is 20% by weight of cement used.



Lime in Concrete

The use of hydrated lime as an addition to portland cement concrete when being mixed is recommended for practically all kinds of concrete work and especially that where a water-tight concrete is sought, such as dams, bridges and foundation walls. It is especially valuable in chuting long distances.

The lime does not replace any ingredient but is an addition—10% of hydrated lime by weight of portland cement used.

The advantage to be derived from adding hydrated lime may be summarized as follows:

(1) Hydrated lime lubricates the mix and renders it mobile enough to flow freely through the chutes and into the forms without the use of excess water.

(2) It positively aids in prevention of segregation of aggregates, thus promoting a rapid flow, and increasing the strength of the concrete.

(3) It gives the concrete sufficient plasticity to work easily after it is deposited in the forms and thereby saves on the cost of labor required for spading and tamping.

(4) It produces smooth exterior surfaces, inasmuch as it promotes intimate contact of the concrete mass with the forms and minimizes the tendency toward honey-combing and hair cracking.

(5) It increases the density and water-tightness of the concrete by virtue of remarkable void filling properties, producing in the concrete intense water resisting properties.

(6) It eliminates the tendency toward cracking because it minimizes alternate expansion and contraction due to moisture changes.



Lime in Concrete

(Continued)

(7) Lime added in small amounts does not weaken the compressive strength of concrete, and in fact, adds to the strength. The following tests made at the University of Michigan, 1:2:4 mix, portland cement and hydrated lime, sand and gravel, are of interest:

Hydrated lime	Age in days				
	14	28	60	90	
0%	(3) 723	(4) 932	(5) 1155	(5) 1393	
10%	(4) 1419	(4) 1703	(5) 2099	(5) 2221	

Water-Tightness

How lime adds to the water-tightness of concrete has been brought out in a series of tests conducted by Sanford E. Thompson, of Boston.

The specimens were concrete cubes in which iron pipes were imbedded. Water pressure was applied through these pipes. The following results were obtained:

Per cent hydrated lime	Age in days	Flow under 7-ft. head			Flow under pressure of 60 pounds per sq. in.		
		measured flow in hours	Flow in grams per hour	Age in days	Press. apl'd before measure in hrs.	Duration of measured flow in hours	Flow in grams per hour
1:2:4 Concrete							
1	18	161	2.7	40	24	4 $\frac{1}{4}$	74.8
4	18	161	1.2	41	18	5	28.4
7	18	161	1.0	42	18	6 $\frac{3}{4}$	5.2
10	15	161	1.0	46	6	18	1.6
1:2.5:4.5 Concrete							
0	30	169	1.9	45	18	6	32.5
10	29	169	0.8	49	..	11	0.0
14	29	169	0.7	50	..	27	0.0
1:3:5 Concrete							
0	26	169	9.8	50	6	14	70.6
8	26	169	1.1	51	8	17	3.6
14	28	169	1.1	50	28	13	10.7
20	28	169	1.2	53	9	15	0.7



Lime in Concrete

(Continued)

Commenting on these tests, Col. Thompson had this to say before the American Society for Testing Materials:

"The cost of large waterproof concrete structures frequently may be reduced by employing leaner proportions of concrete with hydrated lime admixtures, and small structures, such as tanks, may be made more water-tight. Altho the character of the sand and stone used in the concrete will affect the best percentage of lime to use, the present materials are representative of average materials throughout the country, so that the results should be of general application. Coarser sand would naturally require slightly larger percentages of lime, and finer sand (that is sands having a larger percentage of fine grains, which pass a sieve with 40 meshes to the linear inch) would be likely to require less lime, since sands containing considerable fine material produce a more nearly water-tight concrete."



Lime, added to concrete when mixed, helps to hold the ingredients together and so "lubricates" the mass that it chutes more freely.



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The Kelley Island Lime & Transport Company is the largest producer of lime and limestone products in the world. It was organized nearly 38 years ago, and has shown a steady and healthy growth.

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Through its Architectural Service and Information Department this company will be glad to discuss with architects or builders any problems in connection with the use of lime.



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TIGER FINISH



"Spreads like warm butter"